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European Technical Assessment

ETA 18/0284
of 15/12/2019

General Part

Technical Assessment Body issuing the European Technical Assessment Technický a zkušební ústav stavební Praha, s.p.	
Trade name of the construction product	Sheh Fung Chipboard Screws, Timber Construction Screws and Timber Construction Self Drilling Screws SF
Product family to which the construction product belongs	Product area code: 13 Screws for use in timber constructions
Manufacturer	Sheh Fung Screws Co., Ltd. 810, Fusing W. Rd. Ciaotou Kaohsiung City 825, Taiwan (R.O.C.)
Manufacturing plant	Sheh Fung Screws Co., Ltd. 810, Fusing W. Rd. Ciaotou Kaohsiung City 825, Taiwan (R.O.C.)
This European Technical Assessment contains	26 pages including 3 Annexes, which form an integral part of this European Technical Assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 130118-01-0603 Screws and threaded rods for use in timber constructions
This version replaces	ETA 18/0284, version 02 issued on 04/07/2019

Specific Parts

1 Technical description of the product

Sheh Fung Screws Co., Ltd. is a manufacturer of screws with a trade name Sheh Fung Chipboard Screws, type M3.0, M3.5, M4.0, M4.5, M5.0, M6.0 with double flat head made from hardened carbon steel Grade C1022, Timber Construction Screws, type M5.0, M6.0, M8.0, M10.0 with double flat or mod. truss head made from hardened carbon steel Grade C10B21 and Timber Construction Self Drilling Screws SF, type M5.0, M6.0, M8.0, M10.0 with double flat or cylinder head made from hardened carbon steel Grade C10B21 with corrosion protection layer. The screws are full thread or partial thread. The surface treatment of the screws is zinc plated and yellow zinc plated.

Trade name of construction product	Diameter	Type of head	Thread type	Declared length [mm]
Chipboard Screws	M3.0	Double Flat	Full thread	16~40
			Partial thread	
	M3.5	Double Flat	Full thread	18~40
			Partial thread	
	M4.0	Double Flat	Full thread	20~80
			Partial thread	
	M4.5	Double Flat	Full thread	25~80
			Partial thread	
	M5.0	Double Flat	Full thread	25~160
			Partial thread	
	M6.0	Double Flat	Full thread	40~240
			Partial thread	
Timber Construction Screws	M5.0	Double Flat	Full thread	40~200
			Partial thread	
			Partial thread w/ pineapple thread	
			Partial thread w/ 6 knurling thread	
		Mod. Truss	Full thread	
			Partial thread	
			Partial thread w/ pineapple thread	
			Partial thread w/ 6 knurling thread	
	M6.0	Double Flat	Full thread	40~300
			Partial thread	
			Partial thread w/ pineapple thread	
			Partial thread w/ 6 knurling thread	
		Mod. Truss	Full thread	
			Partial thread	
			Partial thread w/ pineapple thread	

			Partial thread w/ 6 knurling thread	
	M8.0	Double Flat	Full thread	50~600
			Partial thread	
			Partial thread w/ pineapple thread	
			Partial thread w/ 6 knurling thread	
		Mod. Truss	Full thread	
			Partial thread	
			Partial thread w/ pineapple thread	
			Partial thread w/ 6 knurling thread	
	M10.0	Double Flat	Full thread	60~600
			Partial thread	
			Partial thread w/ pineapple thread	
			Partial thread w/ 6 knurling thread	
		Mod. Truss	Full thread	
			Partial thread	
			Partial thread w/ pineapple thread	
			Partial thread w/ 6 knurling thread	
Timber Construction Self Drilling Screws	M5.0	Double Flat	Full thread	40~200
		Cylinder	Full thread	
	M6.0	Double Flat	Full thread	40~300
		Cylinder	Full thread	
	M8.0	Double Flat	Full thread	50~600
		Cylinder	Full thread	
	M10.0	Double Flat	Full thread	60~600
		Cylinder	Full thread	

1.1 Shape and dimensions

The nominal diameter (outer thread diameter), *d*, shall not be less than 3.0 mm and shall not be greater than 10.0 mm. The overall length, *L*, of screws shall not be less than 16 mm and shall not be greater than 600 mm. Other geometric attributes are described in Annex 1.

2 Specification of the intended use(s) in accordance with the applicable European Assessment Document (hereinafter EAD)

The screws are intended to be used for connecting wood-based members where requirements for mechanical resistance and stability and safety in use shall be fulfilled. The screws are used for connections in load bearing timber structures between wood-based members:

- Solid timber (softwood) according to EN 338[1] / EN 14081-1[2]
- Glued laminated timber (softwood) according to EN 14080[3]
- Laminated veneer lumber LVL according to EN 14374[4]
- Glued laminated solid timber according to EN 14080[3]
- Cross laminated timber according to European Technical Assessments or national provisions that apply at the installation site

The screws may be used for connecting the following wood-based panels or steel to the timber members mentioned above:

- Plywood according to EN 636+A1[5] and EN 13986+A1[6]
- Oriented Strand Board, OSB according to EN 300[7] and EN 13986+A1[6]
- Particleboard according to EN 312[8] and EN 13986+A1[6]
- Fibreboards according to EN 622-2[9], EN 622-3[10] and EN 13986+A1[6]
- Cement-bonded particle boards according to national provisions that apply at the building site
- Solid-wood panels according to national provisions that apply at the building site

Steel plate and wood-based panels except solid wood panels, laminated veneer lumber and cross laminated timber shall only be located on the side of the screw head.
Sheh Fung screws with an outer thread diameter of at least 6 mm may be used for the fixing of thermal insulation material on top of rafters.

According to EN 1995-1-1[11] the screws made from special stainless or carbon steel with $d > 4$ mm may be used in timber structures subject to climate conditions defined by service classes 1 and 2. According to EN 1995-1-1 the screws made from special stainless or carbon steel with $d \leq 4$ mm may be used in timber structures subject to climate conditions defined by service class 1. Regarding environmental conditions national provisions shall apply at the building site.

Corrosive categories according to EN ISO 12944-2 shall be taken into account.

The use of the screws shall be limited to static and quasi/static actions.

The provisions made in this European Technical Assessment are based on an assumed minimum working life of 50 years, provided that the screws are subject to appropriate use and maintenance.

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1 EN 338:2016 Timber structures - Strength classes
2 EN 14081-1:2016 Timber structures - Strength graded structural timber with rectangular cross section - Part 1: General requirements
3 EN 14080:2013 Timber structures - Glued laminated timber and glued solid timber - Requirements
4 EN 14374:2005 Timber structures - Structural laminated veneer lumber - Requirements
5 EN 636:2015 Plywood - Specification
6 EN 13986+A1:2015 Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking
7 EN 300:2006 Oriented strand boards (OSB) - Definition, classification and specifications
8 EN 312:2003 Particleboards - Specifications
9 EN 622-2:2005 Fibreboards - Specifications - Part 2: Requirements for hardboards
10 EN 622-3:2005 Fibreboards - Specifications - Part 3: Requirements for medium boards
11 EN 1995-1-1:2006 Design of timber structures - Part 1-1: General - Common rules and rules for buildings

The indications given as to the working life cannot be interpreted as a guarantee given by the producer or Technical Assessment Body but are regarded only as a mean for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

The assessment of the fitness for use of the Sheh Fung screws according to the basic work requirements (BWR) were carried out in compliance with EAD 130118-01-0603.

The European Technical Assessment is issued for the screws on the basis of agreed data and information, deposited at Technický a zkušební ústav stavební Praha, s.p., which identifies screws that has been assessed and judged. Changes to the screws or production process which could result in this deposited data and information being incorrect should be notified to Technický a zkušební ústav stavební Praha, s.p. before the changes are introduced. Technický a zkušební ústav stavební Praha, s.p. will decide whether or not such changes affect the ETA and consequently the validity of the CE marking on the basis of the ETA and if so whether further assessment or alternations to the ETA shall be necessary.

Table 1 Essential characteristics of the product

	Essential characteristic	Performance
3.1 BWR 1: Mechanical resistance and stability		
3.1.1	Dimensions	See Annex 2
3.1.2	Characteristic yield moment	See Annex 2
3.1.3	Characteristic withdrawal parameter	See Annex 2
3.1.4	Characteristic head pull-through parameter	See Annex 2
3.1.5	Characteristic tensile strength	See Annex 2
3.1.6	Characteristic yield strength	See Annex 2
3.1.7	Characteristic torsional strength	See Annex 2
3.1.8	Insertion moment	See Annex 2
3.1.9	Bending angle	See Annex 2
3.1.10	Durability against corrosion	See Annex 2
3.1.11	Spacing, end and edge distances of the screws and minimum thickness of the wood-based material	Point 3.1.10
3.1.12	Slip modulus for mainly axially loaded screws	No performance assessed
3.2 BWR 2: Safety in case of fire		
3.2.1	Reaction to fire	Sheh Fung screws are made of carbon steel classified as Euroclass A1 in accordance with EC decision 96/603/EC, as amended by EC
3.3 BWR 3: Hygiene, health and the environment		
3.3.1	Content, emission and/or release of dangerous substances	The product does not contain cadmium or any other dangerous substances.

	Essential characteristic	Performance
BWR 4: Safety and accessibility in use		
Same as BWR 1		

3.1 Mechanical resistance and stability (BWR 1)

Annex 2 contains essential characteristics for Sheh Fung screws. The design and construction shall be carried out according to national provisions that apply at the installation site in line with the partial safety factor format, e.g. in accordance with EN 1995-1-1.

3.1.1 Dimensions

The dimensions were measured according to provisions in EN 14592+A1. The dimensions are documented in tables under Annex 2.

3.1.2 Characteristic yield moment

The characteristic yield moment $M_{y,k}$ has been determined by tests according to EN 409. The test results are documented in tables under Annex 2.

3.1.3 Characteristic withdrawal parameter

The characteristic withdrawal parameters $f_{ax,0,k}$ and $f_{ax,90,k}$ have been determined by tests according to EN 1382. Density of used timber was 350 kg·m^{-3}. The test results are documented in tables under Annex 2 and relevant test reports.

For angles α between screw axis and grain direction $15° \leq \alpha < 45°$ the characteristic withdrawal capacity $F_{ax,\alpha,Rk}$ shall be determined according to equation:

$F_{ax,\alpha,Rk} = k_{ax} \cdot f_{ax,90,k} \cdot d \cdot l_{ef} \cdot (\rho_k/350)^{0,8}$

where

k_{ax} factor to consider the influence of the angle between screw axis and grain direction and the long-term behaviour
$k_{ax} = 0,3+(0,7 \cdot \alpha)/45°$

$f_{ax,90,k}$ short-term characteristic withdrawal parameter for an angle α between screw axis and grain direction of 90° in N/mm^2

d outer thread diameter of the screw in mm

l_{ef} penetration length of the threaded part of the screw in the timber member in mm

ρ_k characteristic density of the wood-based member in kg/m^3

For angle α between screw axis and grain direction $0° \leq \alpha < 15°$ the following requirements were fulfilled and relevant equations can be used:

1. $f_{ax,0,k} / f_{ax,90,k} \geq 0.6$
2. The penetration length of the threaded part of the screws shall be

$$l_{ef,req} = min \begin{cases} \frac{4.d}{\sin \alpha} \\ 20.d \end{cases}$$

3. At least four screws shall be used in a connection with screws inserted in the timber member with an angle between screw axis and grain direction of less than 15°.

3.1.4 Characteristic head pull-through parameter

The characteristic head pull-through parameter $f_{head,k}$ has been determined by tests according to EN 1383. Density of used timber was 350 kg·m^{-3}. The test results are documented in tables under Annex 2.

3.1.5 Characteristic tensile strength

The characteristic tensile strength $f_{tens,k}$ has been determined by tests according to EN 1383. The test results are documented in tables under Annex 2.

3.1.6 Characteristic yield strength

The characteristic yield strength has been determined by tests according to EN 1383. The test results are documented in tables under Annex 2.

3.1.7 Characteristic torsional strength

The characteristic torsional strength $f_{tor,k}$ has been determined by tests according to EN ISO 10666. The test results are documented in tables under Annex 2.

3.1.8 Insertion moment

The characteristic insertion moment $R_{tor,k}$ has been determined by tests according to EN 15737. The characteristic torsional ratio $f_{tor,k}/R_{tor,k} \geq 1.5$ has been fulfilled for all types of screws. The test results are documented in tables under Annex 2.

3.1.9 Bending angle

The bending angle has been determined for each specimen. The test results are documented in tables under Annex 2.

3.1.10 Durability against corrosion

The screws are made from carbon steel C1022 or C10B21 with corrosion protection layer. The screws are zinc plated. The thickness of the zinc coating was measured for each specimen in accordance with EN ISO 2178. The test results are documented in tables under Annex 2.

3.1.11 Spacing, end and edge distances of the screws and minimum thickness of the wood-based material

Laterally loaded screws

For Sheh Fung screws the minimum spacing, end and edge distances are given in EN 1995-1-1, clause 8.7.1.

Axially loaded screws
For Sheh Fung screws the minimum spacing, end and edge distances are given in EN 1995-1-1, clause 8.7.2 and Table 8.6.

3.1.12 Slip modulus for mainly axially loaded screws

No performance assessed.

3.2 Safety in case of fire (BWR 2)

3.2.1 Reaction to fire

Sheh Fung screws are made of carbon steel C1022 or C10B21 classified as Euroclass A1 in accordance with EC decision 96/603/EC, as amended by EC.

3.3 Hygiene, health and the environment (BWR 3)

3.3.1 Content, emission and/or release of dangerous substances

The manufacturer submitted a written declaration the product does not contain cadmium or any other dangerous substances.

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

According to the decision 1997/0176/EC[12], of the European Commission the system(s) of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No 305/2011 and Commission delegated Regulation (EU) No 568/2014) given in the following table applies:

Product(s)	Intended use(s)	Level(s) or class(es)	System(s)
Fasteners for structural timber products	Structural timber products		3

The system 3 referred above is described in Construction Products Regulation (EU) No. 305/2011, Annex V, clauses 1.4.

[12] 1997/0176/EC - European Commission decision of 17/2/1997, published in the Official Journal of the European Communities No L 73/19

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at the Technický a zkušební ústav stavební Praha, s.p.

Issued in Prague on 15/12/2019

By

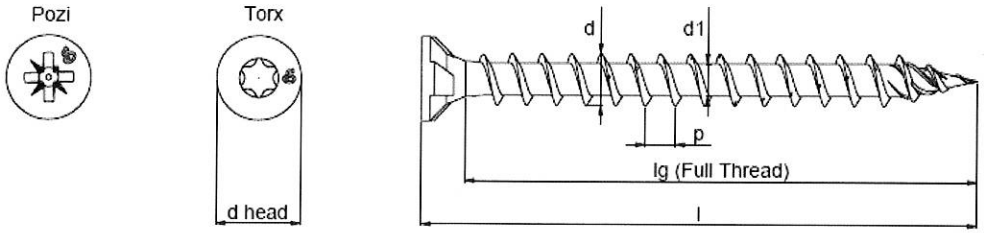
Mária Schaan
Head of the TAB

Annexes:

Annex 1	Dimensions and tolerances of Sheh Fung Screws
Annex 2	Essential characteristics of Sheh Fung Screws
Annex 3	Reference documents

Annex 1 Dimensions and tolerances of Chipboard Screws / Timber Construction Screws / Timber Construction Self Drilling Screws

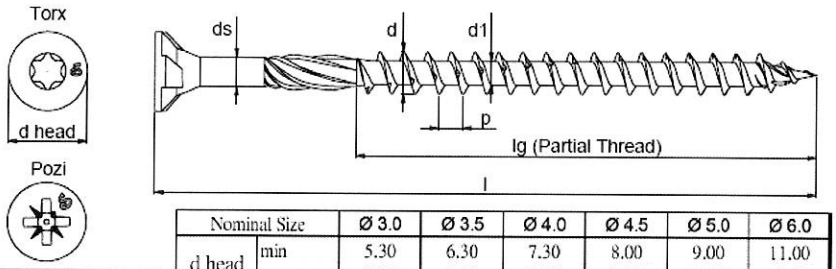
Chipboard Screws with double flat head (full thread)



l (Length)	Length Tolerance
11~18(incl.)	±1.5
19~30(incl.)	±1.7
31~50(incl.)	±2.0
51~80(incl.)	±2.3
81~120(incl.)	±2.7
121~180(incl.)	±3.2
181~250(incl.)	±3.6

Nominal Size		Ø3.0	Ø3.5	Ø4.0	Ø4.5	Ø5.0	Ø6.0
d head	min	5.30	6.30	7.30	8.00	9.00	11.00
	max	6.30	7.30	8.30	9.00	10.00	12.00
d	min	2.70	3.20	3.70	4.20	4.70	5.70
	max	3.30	3.80	4.30	4.80	5.30	6.30
d1	min	1.80	2.00	2.50	2.70	3.00	3.60
	max	2.20	2.40	2.90	3.20	3.50	4.10
p	min	1.65	1.95	2.35	2.65	2.95	3.60
	max	1.95	2.25	2.65	2.95	3.25	3.90
Drive	Torx	T10	T10	T15	T20	T20	T25
	Torx	T15	T15	T20	T25	T25	T30
	Pozi	PZ1	PZ2	PZ2	PZ2	PZ2	PZ3
Yield Moment		≧31°	≧28°	≧27°	≧26°	≧25°	≧23°
Length (mm)		16~40	18~40	20~80	25~80	25~160	40~240

Chipboard Screws with double flat head (partial thread)

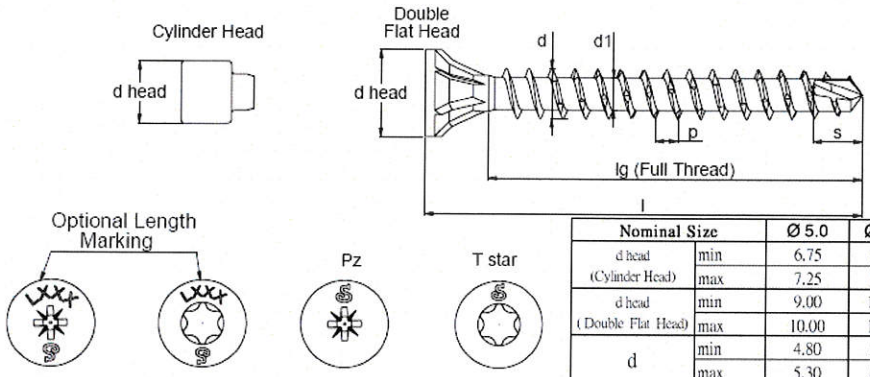


Length	Length Tolerance
11~18(incl.)	±1.5
19~30(incl.)	±1.7
31~50(incl.)	±2.0
51~80(incl.)	±2.3
81~120(incl.)	±2.7
121~180(incl.)	±3.2
181~250(incl.)	±3.6

Thread Length						
Length	Ø3.0	Ø3.5	Ø4.0	Ø4.5	Ø5.0	Ø6.0
40	24	24	25	25	25	25
45			28	28	28	28
50			32	32	32	32
60			37	37	37	37
70			42	42	42	42
80			48	48	48	48
90					55	55
100					65	65
120					65	65
130					65	65
140					65	65
160					65	65
180						65
200						65
220						65
240						65

Nominal Size		Ø3.0	Ø3.5	Ø4.0	Ø4.5	Ø5.0	Ø6.0
d head	min	5.30	6.30	7.30	8.00	9.00	11.00
	max	6.30	7.30	8.30	9.00	10.00	12.00
ds	min	2.00	2.35	2.85	3.20	3.50	4.10
	max	2.30	2.65	3.15	3.50	3.80	4.40
d	min	2.70	3.20	3.70	4.20	4.70	5.70
	max	3.30	3.80	4.30	4.80	5.30	6.30
d1	min	1.80	2.00	2.50	2.70	3.00	3.60
	max	2.20	2.40	2.90	3.20	3.50	4.10
p	min	1.65	1.95	2.35	2.65	2.95	3.60
	max	1.95	2.25	2.65	2.95	3.25	3.90
Drive	Torx	T10	T10	T15	T20	T20	T25
	Torx	T15	T15	T20	T25	T25	T30
	Pozi	PZ1	PZ2	PZ2	PZ2	PZ2	PZ3
Yield Moment		≧31°	≧28°	≧27°	≧26°	≧25°	≧23°
Length (mm)		40	40	40~80	40~80	40~160	40~240

Timber Construction Self Drilling Screws with double flat head / cylinder head

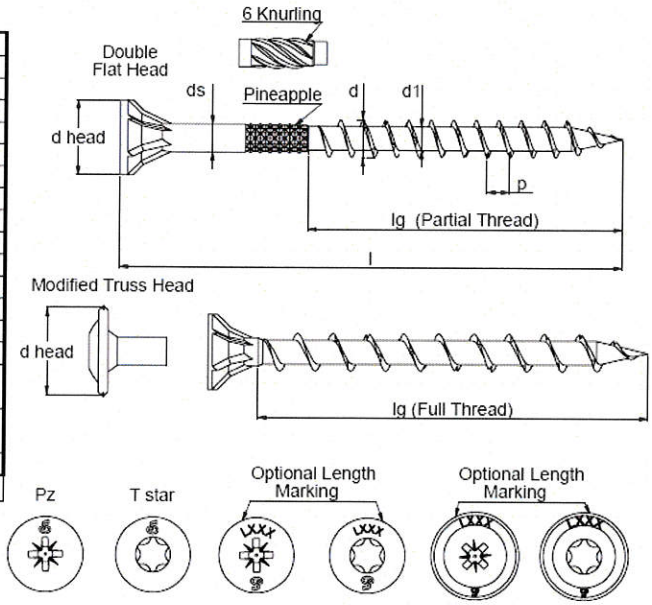


Length Tolerance +/-				
Nominal Size	Ø 5.0	Ø 6.0	Ø 8.0	Ø 10.0
40~100	2	2	2	2
110~200	2.5	2.5	2.7	2.7
220~300	-	3	3.5	3.5
320~400	-	-	3.5	3.5

Nominal Size		Ø 5.0	Ø 6.0	Ø 8.0	Ø 10.0
d head (Cylinder Head)	min	6.75	8.15	9.50	11.50
	max	7.25	8.65	10.25	12.50
d head (Double Flat Head)	min	9.00	11.50	13.50	17.50
	max	10.00	12.50	14.50	18.50
d	min	4.80	5.80	7.70	9.70
	max	5.30	6.30	8.45	10.55
d1	min	3.00	3.65	4.95	6.15
	max	3.50	4.15	5.45	6.75
p	min	2.10	2.40	3.30	4.15
	max	2.50	2.80	3.90	4.95
s	min	3.00	3.50	4.20	5.75
	max	7.00	7.50	8.00	9.00
Drive	T	25	30	40	50
	Pz	2	3	4	4
Yield moment		≥ 25°	≥ 23°	≥ 21°	≥ 19°
Length (mm)		40~200	40~300	50~400	60~400

Timber Construction Screws with double flat head / modified truss head

Nominal Size		Ø 5.0	Ø 6.0	Ø 8.0	Ø 10.0
d head (Modified Truss Head)	min	11.50	13.50	21.00	24.50
	max	12.50	14.50	22.00	25.50
d head (Double Flat Head)	min	9.00	11.50	13.50	17.50
	max	10.00	12.50	14.50	18.50
d	min	4.80	5.80	7.70	9.70
	max	5.30	6.30	8.45	10.55
d1	min	3.00	3.65	5.05	6.15
	max	3.50	4.20	5.60	6.75
ds	min	3.50	4.10	5.50	6.80
	max	4.00	4.60	6.00	7.30
p	min	2.90	3.35	5.20	6.10
	max	3.30	3.85	6.00	7.00
Drive	T	25	30	40	50
	Pz	2	3	4	4
Note 1: Knurling available on lengths ≥		70	70	90	90
Note 2: Full Length max length		200	300	440	440
Yield moment		≥ 25°	≥ 23°	≥ 21°	≥ 19°
Length (mm)		40~200	40~300	50~600	60~600



Annex 2 Essential characteristics of Chipboard Screws / Timber Construction Screws / Timber Construction Self Drilling Screws

3.1 Mechanical resistance and stability (BWR 1)

Chipboard Screws ø 3.0 mm, double flat head, full thread, material: carbon steel C1022

3.1.1	Dimensions		
d		[mm]	3.07
d_1 (1.8 to 2.7)			1.96
d_h			5.82
p (pitch thread)			1.83
l_g (min 12.0)			25.61
l			29.39
3.1.2	Characteristic yield moment		
$M_{y,k}$		[Nmm]	1789
3.1.3	Characteristic withdrawal parameter		
$f_{ax,90,k}$		[N/mm²]	16.17*
$f_{ax,0,k}$			11.62*
3.1.4	Characteristic head pull-through parameter		
$f_{head,k}$		[N/mm²]	27.35*
3.1.5	Characteristic tensile capacity		
$f_{tens,k}$		[kN]	3.08
3.1.6	Average value of yield strength		
R_m		[MPa]	1139.9
$R_{p0.2}$			1098.7
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)		
$f_{tor,k}$ / $R_{tor,k}$		[Nm] / [Nm]	1.37/0.26 = 5.39
3.1.9	Average value of bending angle		
Bending angle		[°]	42.39
3.1.10	Average value of protective layer thickness (durability against corrosion)		
Protective layer thickness		[µm]	17.39

* density of used timber 350 kg/m³

Chipboard Screws ø 3.5 mm, double flat head, full thread, material: carbon steel C1022

3.1.1	Dimensions		
d		[mm]	3.59
d_1 (2.1 to 3.15)			2.25
d_h			6.84
p (pitch thread)			2.11
l_g (min 14.0)			35.05
l			38.89
3.1.2	Characteristic yield moment		
$M_{y,k}$		[Nmm]	3234
3.1.3	Characteristic withdrawal parameter		
$f_{ax,90,k}$		[N/mm^2]	16.88*
$f_{ax,0,k}$			12.89*
3.1.4	Characteristic head pull-through parameter		
$f_{head,k}$		[N/mm^2]	26.74*
3.1.5	Characteristic tensile capacity		
$f_{tens,k}$		[kN]	4.22
3.1.6	Average value of yield strength		
R_m		[MPa]	1188.3
$R_{p0.2}$			1157.5
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)		
$f_{tor,k}$ / $R_{tor,k}$		[Nm] / [Nm]	2.13/0.40 = 5.37
3.1.9	Average value of bending angle		
Bending angle		[°]	41.26
3.1.10	Average value of protective layer thickness (durability against corrosion)		
Protective layer thickness		[µm]	21.59

* density of used timber 350 kg/m^3

Chipboard Screws ø 4.0 mm, double flat head, full or partial thread, material: carbon steel C1022

3.1.1	Dimensions			
			Full thread	Partial thread
d		[mm]	4.07	4.21
d_1 (2.4 to 3.6)			2.77	2.76
d_h			7.65	7.68
d_s (smooth part)			-	3.01
p (pitch thread)			2.58	2.59
l_g (min 16.0)			64.79	36.74
l			69.25	68.66
3.1.2	Characteristic yield moment			
			Full thread	Partial thread
$M_{y,k}$		[Nmm]	5700	5262
3.1.3	Characteristic withdrawal parameter			
			Full thread	Partial thread
$f_{ax,90,k}$		[N/mm²]	16.44*	16.42*
$f_{ax,0,k}$			12.44*	12.60*
3.1.4	Characteristic head pull-through parameter			
			Full thread	Partial thread
$f_{head,k}$		[N/mm²]	25.81*	24.93*
3.1.5	Characteristic tensile capacity			
			Full thread	Partial thread
$f_{tens,k}$		[kN]	7.03	6,77
3.1.6	Average value of yield strength			
			Full thread	Partial thread
R_m		[MPa]	1294.7	1248.0
$R_{p0.2}$			1265.7	1216.5
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)			
			Full thread	Partial thread
$f_{tor,k}$ / $R_{tor,k}$		[Nm] / [Nm]	4.22/0.70 = 5.99	4.18/0.72 = 5.83
3.1.9	Average value of bending angle			
			Full thread	Partial thread
Bending angle		[°]	38.59	38.48
3.1.10	Average value of protective layer thickness (durability against corrosion)			
Protective layer thickness		[µm]	25.5	

* density of used timber 350 kg/m³

Chipboard Screws ø 4.5 mm, double flat head, full or partial thread, material: carbon steel C1022

3.1.1	Dimensions			
			Full thread	Partial thread
d		[mm]	4.57	4.55
d_1 (2.7 to 4.05)			3.05	3.06
d_h			8.50	8.56
d_s (smooth part)			-	3.35
p (pitch thread)			2.84	2.85
l_g (min 16.0)			54.31	42.51
l			59.16	69.29
3.1.2	Characteristic yield moment			
			Full thread	Partial thread
$M_{y,k}$		[Nmm]	7678	7227
3.1.3	Characteristic withdrawal parameter			
			Full thread	Partial thread
$f_{ax,90,k}$		[N/mm²]	16.62*	16.64*
$f_{ax,0,k}$			12.56*	12.49*
3.1.4	Characteristic head pull-through parameter			
			Full thread	Partial thread
$f_{head,k}$		[N/mm²]	24.06*	24.26*
3.1.5	Characteristic tensile capacity			
			Full thread	Partial thread
$f_{tens,k}$		[kN]	8.17	8.53
3.1.6	Average value of yield strength			
			Full thread	Partial thread
R_m		[MPa]	1241.9	1297.2
$R_{p0.2}$			1219.7	1278.1
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)			
			Full thread	Partial thread
$f_{tor,k}$ / $R_{tor,k}$		[Nm] / [Nm]	5.50/0.95= 5.80	5.70/1.03 = 5.51
3.1.9	Average value of bending angle			
			Full thread	Partial thread
Bending angle		[°]	36.85	37.55
3.1.10	Average value of protective layer thickness (durability against corrosion)			
Protective layer thickness		[µm]	16.13	

* density of used timber 350 kg/m³

Chipboard Screws ø 5.0 mm, double flat head, full or partial thread, material: carbon steel C1022

3.1.1	Dimensions			
			Full thread	Partial thread
d		[mm]	5.063	5.099
d_1 (3.0 to 4.5)			3.32	3.32
d_h			9.44	9.44
d_s (smooth part)			-	3.65
p (pitch thread)			3.0946	3.0923
l_g (min 20.0)			54.69	65.41
l			59.172	119.324
3.1.2	Characteristic yield moment			
			Full thread	Partial thread
$M_{y,k}$		[Nmm]	9409	9061 (thread section)
			-	9867 (smooth section)
3.1.3	Characteristic withdrawal parameter			
			Full thread	Partial thread
$f_{ax,90,k}$		[N/mm²]	16.41*	16.04*
$f_{ax,0,k}$			11.34*	12.05*
3.1.4	Characteristic head pull-through parameter			
			Full thread	Partial thread
$f_{head,k}$		[N/mm²]	22.43	23.27
3.1.5	Characteristic tensile capacity			
			Full thread	Partial thread
$f_{tens,k}$		[kN]	10.09	9.98
3.1.6	Average value of yield strength			
			Full thread	Partial thread
R_m		[MPa]	1293.9	1279.7
$R_{p0.2}$			1274.7	1238.4
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)			
			Full thread	Partial thread
$f_{tor,k}$ / $R_{tor,k}$		[Nm] / [Nm]	7.34/1.23 = 5.96	7.35/1.17 = 6.28
3.1.9	Average value of bending angle			
			Full thread	Partial thread
Bending angle		[°]	37.87	36.11
3.1.10	Average value of protective layer thickness (durability against corrosion)			
Protective layer thickness		[µm]	24.2	

* density of used timber 350 kg/m³

Chipboard Screws ø 6.0 mm, double flat head, full or partial thread, material: carbon steel C1022

3.1.1	Dimensions			
			Full thread	Partial thread
d		[mm]	5.971	6.189
d_1 (3.0 to 4.5)			3.84	3.97
d_h			11.86	11.21
d_s (smooth part)			-	4.36
p (pitch thread)			3.6974	3.7161
l_g (min 24.0)			54.89	65.96
l			59.008	198.648
3.1.2	Characteristic yield moment			
			Full thread	Partial thread
$M_{y,k}$		[Nmm]	10000	10000 (thread section)
			-	10000 (smooth section)
3.1.3	Characteristic withdrawal parameter			
			Full thread	Partial thread
$f_{ax,90,k}$		[N/mm²]	16.13*	16.07*
$f_{ax,0,k}$			12.21*	11.95*
3.1.4	Characteristic head pull-through parameter			
			Full thread	Partial thread
$f_{head,k}$		[N/mm²]	20.85	21.08
3.1.5	Characteristic tensile capacity			
			Full thread	Partial thread
$f_{tens,k}$		[kN]	12.00	12.00
3.1.6	Average value of yield strength			
			Full thread	Partial thread
R_m		[MPa]	1267.4	1245.0
$R_{p0.2}$			1232.3	1214.5
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)			
			Full thread	Partial thread
$f_{tor,k}$ / $R_{tor,k}$		[Nm] / [Nm]	12.00/2.13 = 5.63	12.00/3.18 = 3.77
3.1.9	Average value of bending angle			
			Full thread	Partial thread
Bending angle		[°]	33.12	33.69
3.1.10	Average value of protective layer thickness (durability against corrosion)			
Protective layer thickness		[µm]	20.3	

* density of used timber 350 kg/m³

Timber Construction Screws ø 5.0 mm, double flat head and mod. truss head, full or partial thread, material: carbon steel C10B21

3.1.1	Dimensions			
			Full thread	Partial thread
d		[mm]	5.08	5.19
d_1 (3.0 to 4.5)			3.54	3.5
d_h			9.77 (double flat head)	9.91
d_h			12.22 (mod. truss head)	
d_s (smooth part)			-	3.85
p (pitch thread)			3.11	3.08
l_g (min 20.0)			192.92	68.83
l			199.99	200.14
3.1.2	Characteristic yield moment			
			Full thread	Partial thread
$M_{y,k}$		[Nmm]	9847	9799 (thread section)
			-	9956 (smooth section)
3.1.3	Characteristic withdrawal parameter			
			Full thread	Partial thread
$f_{ax,90,k}$		[N/mm²]	16.11*	16.42*
$f_{ax,0,k}$			12.15*	11.73*
3.1.4	Characteristic head pull-through parameter			
			Full thread	Partial thread
$f_{head,k}$		[N/mm²]	23.03 (*, double flat head)	23.05 (*, double flat head)
			30.21 (*, mod. truss head)	
3.1.5	Characteristic tensile capacity			
			Full thread	Partial thread
$f_{tens,k}$		[kN]	9.87	10.98
3.1.6	Average value of yield strength			
			Full thread	Partial thread
R_m		[MPa]	1113.5	1259.9
$R_{p0.2}$			1070.8	1236.3
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)			
			Full thread	Partial thread	Screw length 60 mm
$f_{tor,k}$ / $R_{tor,k}$		[Nm] / [Nm]	7.34/3.81 = 1.93	8.11/3.36 = 2.42	7.34/1.23 = 5.96
3.1.9	Average value of bending angle			
			Full thread	Partial thread
Bending angle		[°]	37.87	36.11
3.1.10	Average value of protective layer thickness (durability against corrosion)			
Protective layer thickness		[µm]	25.75	

* density of used timber 350 kg/m³

Timber Construction Screws ø 6.0 mm, double flat head and mod. truss head, full or partial thread, material: carbon steel C10B21

3.1.1	Dimensions			
			Full thread	Partial thread
d		[mm]	6.13	6.13
d_1 (3.6 to 5.4)			4.24	4.15
d_h			11.96 (double flat head)	11.98
d_h			14.01 (mod. truss head)	-
d_s (smooth part)			-	4.46
p (pitch thread)			3.71	3.69
l_g (min 24.0)			212.57	69.55
l			220.80	220.14
3.1.2	Characteristic yield moment			
			Full thread	Partial thread
$M_{y,k}$		[Nmm]	10000	10000 (thread section)
			-	10000 (smooth section)
3.1.3	Characteristic withdrawal parameter			
			Full thread	Partial thread
$f_{ax,90,k}$		[N/mm²]	16.20*	16.05*
$f_{ax,0,k}$			12.03*	11.57*
3.1.4	Characteristic head pull-through parameter			
			Full thread	Partial thread
$f_{head,k}$		[N/mm²]	20.89 (*, double flat head)	20.40 (*, double flat head)
			30.81 (*, mod. truss head)	-
3.1.5	Characteristic tensile capacity			
			Full thread	Partial thread
$f_{tens,k}$		[kN]	12.00	12.00
3.1.6	Average value of yield strength			
			Full thread	Partial thread
R_m		[MPa]	1177.0	1117.8
$R_{p0.2}$			1096.4	1103.6

3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)			
		Full thread	Partial thread	Screw length 60 mm
$f_{tor,k}$ / $R_{tor,k}$	[Nm] / [Nm]	12.00/6.56 1.83	12.00/4.40 = 2.73	12.00/2.13 = 5.63

3.1.9	Average value of bending angle			
			Full thread	Partial thread
Bending angle		[°]	33.12	33.69
3.1.10	Average value of protective layer thickness (durability against corrosion)			
Protective layer thickness		[µm]	26.21	

* density of used timber 350 kg/m³

Timber Construction Screws ø 8.0 mm, double flat head and mod. truss head, full or partial thread, material: carbon steel C10B21

3.1.1	Dimensions			
			Full thread	Partial thread
d		[mm]	7.99	8.09
d_1 (4.8 to 7.2)			5.67	5.59
d_h			14.12 (double flat head)	14.16
d_h			21.66 (mod. truss head)	-
d_s (smooth part)			-	5.91
p (pitch thread)			5.72	5.72
l_g (min 32.0)			289.35	99.96
l			298.63	300.02
3.1.2	Characteristic yield moment			
			Full thread	Partial thread
$M_{y,k}$		[Nmm]	23000	23000 (thread section)
			-	23000 (smooth section)
3.1.3	Characteristic withdrawal parameter			
			Full thread	Partial thread
$f_{ax,90,k}$		[N/mm²]	15.04*	14.93*
$f_{ax,0,k}$			11.28*	11.36*
3.1.4	Characteristic head pull-through parameter			
			Full thread	Partial thread
$f_{head,k}$		[N/mm²]	19.78 (*, double flat head)	20.06 (*,double flat head)
			24.23 (*, mod. truss head)	-
3.1.5	Characteristic tensile capacity			
			Full thread	Partial thread
$f_{tens,k}$		[kN]	20.00	20.00
3.1.6	Average value of yield strength			
			Full thread	Partial thread
R_m		[MPa]	1185.3	1135.3
$R_{p0.2}$			1157.6	1113.3
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)			
			Full thread	Partial thread
$f_{tor,k}$ / $R_{tor,k}$		[Nm] / [Nm]	25.00/10.72 = 2.33	25.00/8.59 = 2.91
3.1.9	Average value of bending angle			
			Full thread	Partial thread
Bending angle		(°)	33.50	34.21
3.1.10	Average value of protective layer thickness (durability against corrosion)			
Protective layer thickness		[µm]	12.51	

* density of used timber 350 kg/m³

Timber Construction Screws ø 10.0 mm, double flat head and mod. truss head, full or partial thread, material: carbon steel C10B21

3.1.1	Dimensions			
			Full thread	Partial thread
d		[mm]	10.01	10.10
d_1 (6.0 to 9.0)			6.86	6.76
d_h			17.84 (double flat head)	17.91
d_h			25.17 (mod. truss head)	-
d_s (smooth part)			-	7.23
p (pitch thread)			4.73	6.72
l_g (min 40.0)			285.91	98.20
l			299.35	299.39
3.1.2	Characteristic yield moment			
			Full thread	Partial thread
$M_{y,k}$		[Nmm]	36000	36000 (thread section)
			-	36000 (smooth section)
3.1.3	Characteristic withdrawal parameter			
			Full thread	Partial thread
$f_{ax,90,k}$		[N/mm²]	13.82*	13.62*
$f_{ax,0,k}$			11.59*	11.25*
3.1.4	Characteristic head pull-through parameter			
			Full thread	Partial thread
$f_{head,k}$		[N/mm²]	17.04 (*,double flat head)	17.37 (*,double flat head)
			23.10 (*, mod. truss head)	-
3.1.5	Characteristic tensile capacity			
			Full thread	Partial thread
$f_{tens,k}$		[kN]	32.00	32.00
3.1.6	Average value of yield strength			
			Full thread	Partial thread
R_m		[MPa]	1099.6	1130.9
$R_{p0.2}$			1083.9	1108.3
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)			
			Full thread	Partial thread
$f_{tor,k}$ / $R_{tor,k}$		[Nm] / [Nm]	45.00/23.09 = 1.95	45.00/18.18 = 2.48
3.1.9	Average value of bending angle			
			Full thread	Partial thread
Bending angle		[°]	29.70	30.52
3.1.10	Average value of protective layer thickness (durability against corrosion)			
Protective layer thickness		[µm]	20.84	

* density of used timber 350 kg/m³

Timber Construction Self Drilling Screws ø 5.0 mm, double flat and cylinder head, full thread, material: carbon steel C10B21

3.1.1	Dimensions		
			Full thread
d		[mm]	5.084
d_1 (3.0 to 4.5)			3.32
d_h			9.78 (double flat head)
d_h			7.07 (cylinder head)
p (pitch thread)			2.3259
l_g (min 20.0)			191.12
l			200.226
3.1.2	Characteristic yield moment		
			Full thread
$M_{y,k}$		[Nmm]	9801
3.1.3	Characteristic withdrawal parameter		
			Full thread
$f_{ax,90,k}$		[N/mm²]	16.00*
$f_{ax,0,k}$			12.02*
3.1.4	Characteristic head pull-through parameter		
			Full thread
$f_{head,k}$		[N/mm²]	23.27 (*, double flat head)
			29.19 (*, cylinder head)
3.1.5	Characteristic tensile capacity		
			Full thread
$f_{tens,k}$		[kN]	9.28
3.1.6	Average value of yield strength		
			Full thread
R_m		[MPa]	1190
$R_{p0.2}$			1146
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)		
			Full thread
$f_{tor,k}$ / $R_{tor,k}$		[Nm] / [Nm]	6.49/2.37= 2.74
3.1.9	Average value of bending angle		
			Full thread
Bending angle		[°]	37.87
3.1.10	Average value of protective layer thickness (durability against corrosion)		
Protective layer thickness		[µm]	26.0

* density of used timber 350 kg/m³

Timber Construction Self Drilling Screws ø 6.0 mm, double flat and cylinder head, full thread, material: carbon steel C10B21

3.1.1	Dimensions		
			Full thread
d		[mm]	6.197
d_1 (3.6 to 5.4)			3.99
d_h			12.08 (double flat head)
d_h			8.45 (cylinder head)
p (pitch thread)			2.6067
l_g (min 24.0)			288.64
l			299.671
3.1.2	Characteristic yield moment		
			Full thread
$M_{y,k}$		[Nmm]	10000
3.1.3	Characteristic withdrawal parameter		
			Full thread
$f_{ax,90,k}$		[N/mm²]	15.93*
$f_{ax,0,k}$			11.94*
3.1.4	Characteristic head pull-through parameter		
			Full thread
$f_{head,k}$		[N/mm²]	20.77 (*, double flat head)
			30.80 (*, cylinder head)
3.1.5	Characteristic tensile capacity		
			Full thread
$f_{tens,k}$		[kN]	12.00
3.1.6	Average value of yield strength		
			Full thread
R_m		[MPa]	1134
$R_{p0.2}$			1073
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)		
			Full thread
$f_{tor,k}$ / $R_{tor,k}$		[Nm] / [Nm]	10.72/3.61= 2.97
3.1.9	Average value of bending angle		
			Full thread
Bending angle		[°]	33.12
3.1.10	Average value of protective layer thickness (durability against corrosion)		
Protective layer thickness		[µm]	23.0

* density of used timber 350 kg/m³

Timber Construction Self Drilling Screws ø 8.0 mm, double flat head and cylinder head, full thread, material: carbon steel C10B21

3.1.1	Dimensions		
			Full thread
d		[mm]	8.223
d_1 (4.8 to 7.2)			5.49
d_h			14.05 (double flat head)
d_h			9.93 (cylinder head)
p (pitch thread)			3.6879
l_g (min 32.0)			388.99
l			400.099
3.1.2	Characteristic yield moment		
			Full thread
$M_{y,k}$		[Nmm]	23000
3.1.3	Characteristic withdrawal parameter		
			Full thread
$f_{ax,90,k}$		[N/mm²]	15.16*
$f_{ax,0,k}$			11.69*
3.1.4	Characteristic head pull-through parameter		
			Full thread
$f_{head,k}$		[N/mm²]	21.18 (*, double flat head)
			37.11 (*, cylinder head)
3.1.5	Characteristic tensile capacity		
			Full thread
$f_{tens,k}$		[kN]	20.00
3.1.6	Average value of yield strength		
			Full thread
R_m		[MPa]	1084.4
$R_{p0.2}$			1060.7
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)		
			Full thread
$f_{tor,k}$ / $R_{tor,k}$		[Nm] / [Nm]	25.00/8.35= 2.99
3.1.9	Average value of bending angle		
			Full thread
Bending angle		[°]	33.50
3.1.10	Average value of protective layer thickness (durability against corrosion)		
Protective layer thickness		[µm]	17.1

* density of used timber 350 kg/m³

Timber Construction Self Drilling Screws ø 10.0 mm, double flat head and cylinder head, full thread, material: carbon steel C10B21

3.1.1	Dimensions		
			Full thread
d		[mm]	10.135
d_1 (4.8 to 7.2)			6.62
d_h			17.92 (double flat head)
d_h			12.13 (cylinder head)
p (pitch thread)			4.6828
l_g (min 32.0)			385.48
l			398.187
3.1.2	Characteristic yield moment		
			Full thread
$M_{y,k}$		[Nmm]	36000
3.1.3	Characteristic withdrawal parameter		
			Full thread
$f_{ax,90,k}$		[N/mm²]	13.83*
$f_{ax,0,k}$			11.78*
3.1.4	Characteristic head pull-through parameter		
			Full thread
$f_{head,k}$		[N/mm²]	19.09 (*, double flat head)
			29.97 (*, cylinder head)
3.1.5	Characteristic tensile capacity		
			Full thread
$f_{tens,k}$		[kN]	32.00
3.1.6	Average value of yield strength		
			Full thread
R_m		[MPa]	1123.7
$R_{p0.2}$			1064.4
3.1.7 3.1.8	Characteristic torsional ratio (Characteristic torsional strength/Characteristic torsional resistance into timber)		
			Full thread
$f_{tor,k}$ / $R_{tor,k}$		[Nm] / [Nm]	45.00/15.04= 2.99
3.1.9	Average value of bending angle		
			Full thread
Bending angle		[°]	29.70
3.1.10	Average value of protective layer thickness (durability against corrosion)		
Protective layer thickness		[µm]	14.2

* density of used timber 350 kg/m³

Annex 3 Reference documents

[1] European Assessment Document EAD 130118-01-0603 Screws and threaded rods for use in timber constructions (edition March 2019)

[2] Test Reports No. 39-13681/1-8 dated 07.12.2018, 10.12.2018, 10.06.2019 and 13.06.2019 regarding tests of mechanical resistance and stability of screws, issued by Strojírenský zkušební ústav, s.p., workplace Jablonec nad Nisou, Czech Republic

[3] Test Reports No. 39-13681/9-14 dated 10.12.2018, regarding tests of mechanical resistance and stability of screws, issued by Strojírenský zkušební ústav, s.p., workplace Jablonec nad Nisou, Czech Republic

[4] Declaration of RoHS Conformity dated 13.02.2019, issued by Sheh Fung Screws Co., Ltd., Taiwan (R.O.C.)